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C-A OPERATIONS PROCEDURES MANUAL

18.7.2 ERL Cryogenic System Vacuum Skid Operation

Text Pages 2 through 5

Hand Processed Changes

<u>HPC No.</u>	<u>Date</u>	<u>Page Nos.</u>	<u>Initials</u>
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Approved: _____ **Signature on File** _____
Collider-Accelerator Department Chairman Date

D. Lederle

18.7.2 ERL Cryogenic System Vacuum Skid Operation

1. Purpose

This procedure covers the basic operation of the Vacuum Pump Skid for the ERL Cryogenic System.

2. Responsibilities

- 2.1 A shift supervisor, or an operator designated by the shift supervisor, is responsible for implementing the procedure.

3. Prerequisites

- 3.1 Operator shall become familiar with the system P&ID drawings 010604015 and 010604017, the control system screen(s) on the operator station, and the physical location of components.
- 3.2 Prestart checks:
- If an extended period of time has elapsed since last operation, check for freedom of rotation of both Kinney pumps and the Booster pump. Verify main breaker is locked first.
 - Check oil levels of Kinney pumps. Should be approximately even with the centerline of the pump shafts.
 - Check oil level of Booster. Should be approximately at mid position of sight glass.
 - Check valve line-up for oil system. The following valves should be opened, or in a throttled position: V-5A&B, V-6A&B, V-7A&B, V-13, V-14, V9A&B, V10A&B.
 - Verify cooling water supply to the skid and return from the skid are lined up.
 - Verify instrument air is available to the skid.
- 3.3 ESH
- 3.3.1 All personnel working on any electrical system or equipment in the C-AD shall be familiar with BNL [SBMS Electrical Safety](#), BNL [SBMS Lockout/Tagout \(LO/TO\)](#), [C-A-OPM 1.5, "Electrical Safety Implementation Plan"](#), [C-A-OPM 1.5.3 "Procedure to Open or Close Breakers and Switches and Connecting/Disconnecting Plugs"](#), [C-A-OPM 2.36, "Lockout/Tagout for Control of Hazardous Energy"](#). C-AD will provide on-site/work specific training to individuals in the electrical safety aspects of their job functions and assignments.
- 3.3.2 While work is underway and an abnormal condition arises, re-review the job against criteria in applicable SBMS Subject Areas, and/or work planning requirements. If unsure of further actions, discuss situation with supervisor.

4. Precautions

Hearing protection and safety glasses are required in EEBA bldg. when the vacuum pump skid is operating.

5. Procedure

5.1 Manual Start Procedure

- 5.1.1 Obtain handheld infrared temp detector and frequently check bearing temperatures of the Kinney pumps and booster pump until they have stabilized.
- 5.1.2 Verify 10" suction valve H10944A is shut. Verify discharge flow path to atmosphere or compressor suction.
- 5.1.3 Verify "Hand-Off-Auto" switches for the Kinney pumps are in off, and the "Off-Auto" switch for the booster pump is off.
- 5.1.4 Start the "A" Kinney pump by placing the switch to the hand position. Verify the following occurs:
 - 5.1.4.1 The "A" pump starts.
 - 5.1.4.2 Solenoid Valve V-11A opens, supplying cooling water to HX1A. Verify flow by feeling inlet and outlet pipes.
 - 5.1.4.3 The "A" oil pump starts after a 3 second time delay. Immediately verify pump operation and flow.
 - 5.1.4.4 Process inlet valve V-1A should open after 60 sec. If there is excess vibration during this time period, the valve can be opened sooner using the red switch on the valve. With the valve open, the vibration lessens.
- 5.1.5 Start the "B" Kinney pump by placing the switch to the hand position. Verify the following occurs:
 - 5.1.5.1 The "B" pump starts.
 - 5.1.5.2 Solenoid Valve V-11B opens, supplying cooling water to HX1B. Verify flow by feeling inlet and outlet pipes.
 - 5.1.5.3 The "B" oil pump starts after a 3 second time delay. Immediately verify pump operation and flow.

5.1.5.4 Process inlet valve V-1B should open after 60 sec. If there is excess vibration during this time period, the valve can be opened sooner using the red switch on the valve. With the valve open, the vibration lessens.

5.1.6 When system has stabilized, crack open suction valve H10944A. The booster pump will begin to windmill. Closely monitor bearing temperatures while in this mode. When the system pressure is below 35 torr, the booster pump can be started. To start, place the “Off-Auto” switch to auto, and verify the following:

5.1.6.1 The booster pump starts.

5.1.6.2 Solenoid valve V-15 opens supplying oil injection to the blower. Immediately verify oil flow by checking the sight glass just upstream of the solenoid.

5.1.6.3 Solenoid valve V-16 opens supplying cooling water to HX2. Verify water flow by feeling inlet and outlet pipes.

5.1.6.4 Solenoid valve V-17 opens supplying cooling water to the gear oil cooler. Verify water flow by feeling inlet and outlet pipes.

5.1.6.5 Solenoid valve V-17 opens supplying cooling water to the pulley end bearing. Verify water flow by feeling inlet and outlet pipes.

5.1.6 Bypass Valve V-3 operation: Once system pressure is below 35 torr with the booster pump running, the bypass valve can be used to control booster pump suction pressure. First verify valves V-2 and V-4 are open, then place V-3 in auto from the PLC or indusoft work station.

5.2 Auto Start Procedure

5.2.1 The system can be started in auto from the PLC by pressing the F1 key with the Kinney pumps and blower switches in the “Auto” position. Verify the sequence of events described under the manual start procedure occur, and perform all the same system checks. Once the booster pump is running, it may be difficult to crack open the 10” suction valve H10944A without overloading the booster motor.

5.3 Initial Dry Out and Purging Process (Initial commissioning)

The dry-out of the vacuum pump skid system can be performed by supplying nitrogen from a buggy to the 10” suction line via vent valve H10970M while the skid is operating and discharging to atmosphere. Control suction pressure by throttling H10970M.

5.4 Shutdown

In auto mode, shutdown can be initiated by pressing the F2 key. Pressing F2 initiates a shutdown sequence which takes approximately 90 seconds to complete.

In addition, the auto shutdown sequence is initiated if any of the following alarm conditions occur: Low sealant tank level (A or B), high sealant tank temperature (A or B), high booster discharge temperature, low booster inlet temperature.

5.5 Securing the skid and LOTO

After a shutdown, if the skid will be down for a long period, or if maintenance needs to be done, the skid should be secured by applying LOTO to the main 440 volt breaker.

6. **Documentation**

The shift supervisor shall document the completion of the procedure in the cryogenics control room log book.

7. **References**

7.1 Drawing **010604015**

7.2 Drawing: **010604017**

7.3 [C-A-OPM 1.5, "Electrical Safety Implementation Plan"](#).

7.4 [C-A-OPM 1.5.3 "Procedure to Open or Close Breakers and Switches and Connecting/Disconnecting Plugs"](#).

7.5 [C-A-OPM 2.36, "Lockout/Tagout for Control of Hazardous Energy"](#).

7.6 [SBMS Electrical Safety](#).

7.7 [SBMS Lockout/Tagout \(LOTO\)](#).

8. **Attachments**

None